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1     CLAIMS

2           1.     A multi-state handle administration system in which handles are  
3 capable of assuming states comprising:

4                 an unassigned state in which a handle is not assigned to a particular  
5 resource;

6                 an assigned state in which a handle is assigned to a particular resource and  
7 can be dereferenced to obtain a pointer to the resource; and

8                 a suspended state in which a handle is assigned to a particular resource but  
9 cannot be dereferenced to obtain a pointer to that resource.

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11           2.     The handle administration system of claim 1, wherein handles can be  
12 suspended from the assigned state into the suspended state.

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14           3.     The handle administration system of claim 1, wherein handles can be  
15 reinstated from the suspended state into the assigned state.

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17           4.     The handle administration system of claim 1, wherein handles can be  
18 released from the suspended state to the unassigned state.

19  
20           5.     The handle administration system of claim 1, wherein handles can be  
21 released from both the suspended and the assigned states to the unassigned state.

1           6.    The handle administration system of claim 1 further comprising a  
2 handle database that is configured to contain indicia that indicate whether a handle  
3 is assigned, unassigned or suspended.

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5           7.    The handle administration system of claim 6, wherein said indicia  
6 comprises a field for holding a value that indicates that a handle is in a suspended  
7 state.

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9           8.    The handle administration system of claim 6, wherein said indicia  
10 comprises a handle value field for holding a value that indicates that a handle is in  
11 a suspended state.

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13           9.    A handle administrator configured to manage handles that are  
14 associated with resources, the handle administrator being configured to place the  
15 handles in one of more than two possible states which affect whether a handle can  
16 be dereferenced to provide a pointer to the resource with which the handle is  
17 associated.

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19           10.   The handle administrator of claim 9, wherein one of the states  
20 comprises a suspended state in which the handle is associated with a particular  
21 resource but cannot be dereferenced into a pointer to that resource.

1           11.    The handle administrator of claim 10, wherein two of the states  
2 comprise:

3           an assigned state in which a handle is associated with a resource and can be  
4 dereferenced to provide a pointer to that resource; and

5           an unassigned state in which the handle is not associated with any resources  
6 and cannot be dereferenced to provide a pointer to any of the resources.

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8           12.    The handle administrator of claim 11, wherein the handle  
9 administrator is configured to suspend handles from an assigned state into a  
10 suspended state.

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12           13.    The handle administrator of claim 11, wherein the handle  
13 administrator is configured to reinstate handles from a suspended state into an  
14 assigned state.

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16           14.    The handle administrator of claim 11, wherein the handle  
17 administrator is configured to release handles from the suspended state to the  
18 unassigned state.

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20           15.    The handle administrator of claim 11, wherein the handle  
21 administrator is configured to release handles from the suspended state and the  
22 assigned state to the unassigned state.

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24           16.    A handle administration system comprising:  
25 one or more computer-readable media; and

1 software code embodied on the computer-readable media which is  
2 configured implement a handle administration system that comprises:

3 an unassigned state in which a handle is not assigned to a particular  
4 resource;

5 an assigned state in which a handle is assigned to a particular  
6 resource and can be dereferenced to obtain a pointer to the resource; and

7 a suspended state in which a handle is assigned to a particular  
8 resource but cannot be dereferenced to obtain a pointer to that resource.

9  
10 17. A resource management system configured to manage resources  
11 comprising:

12 one or more resources that can be consumed by one or more agents; and

13 a handle administrator configured to administer a handle system in which  
14 handles to the one or more resources are provided to the agents and can be  
15 dereferenced into pointers to the one or more resources, the handle system  
16 comprising more than two states for a handle, the states comprising:

17 an assigned state in which a handle is associated with a resource and  
18 can be dereferenced into a pointer to that resource;

19 an unassigned state in which the handle is not associated with a  
20 resource and cannot be dereferenced into a pointer to any resources; and

21 a suspended state in which the handle is associated with a resource  
22 but cannot be dereferenced into a pointer to any resources.

1       **18.**    The resource management system of claim 17 further comprising  
2 one or more agents that are consumers of one or more resources.

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4       **19.**    The resource management system of claim 17, wherein the handles  
5 can be suspended from the assigned state to the suspended state.

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7       **20.**    The resource management system of claim 17, wherein the handles  
8 can be reinstated from the suspended state to the assigned state.

9  
10       **21.**   The resource management system of claim 17, wherein the handles  
11 can be released from the suspended state to the unassigned state.

12  
13       **22.**   The resource management system of claim 17, wherein the handles  
14 can be released from the suspended and the assigned states to the unassigned state.

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16       **23.**    A resource management system comprising:  
17       at least one computer readable media; and  
18       one or more handle records resident on the media, each record having  
19 fields, one of the fields being configured to provide indicia of whether a handle is  
20 in a state other than an assigned state and an unassigned state.

21  
22       **24.**    The resource management system of claim 23, wherein the other  
23 state comprises a suspended state in which a handle can be associated with a  
24 particular resource, but cannot be dereferenced to obtain a pointer to that resource.  
25

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25. A data structure embodied on a computer-readable medium for use in managing resources, the data structure comprising:

a first portion that is associated with a pointer to a resource; and  
a second portion that is associated with a suspended handle state.

26. The data structure of claim 25, wherein the suspended handle state indicates a handle that is associated with a particular resource but which cannot be dereferenced to obtain a pointer to that resource.

27. The data structure of claim 25, wherein the second portion is configured to hold a value that indicates that a handle is suspended.

28. The data structure of claim 25 further comprising a handle administrator that is configured to use said data structure to manage handles for the resources, the handle administrator being configured to dereference handles into pointers to resources with which the handles are associated.

29. The data structure of claim 28, wherein the handle administrator is configured to receive a handle and determine whether the handle is valid and not suspended before dereferencing it into a pointer.

30. A method of managing resources comprising:  
requesting one or more agents to suspend one or more handles; and  
releasing the suspended handles.

1           **31.**    The method of claim 30, wherein the handles are associated with  
2 one or more resources when they are suspended.

3  
4           **32.**    The method of claim 30, wherein the handles are associated with  
5 one or more resources when they are suspended but cannot be dereferenced into a  
6 pointer for those resources.

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8           **33.**    The method of claim 30, wherein the one or more agents comprise a  
9 plurality of agents, and handles are released only if all of the agents can suspend  
10 the handles.

11  
12           **34.**    The method of claim 30 further comprising reinstating the handle if  
13 one or more of the agents could not suspend the handle.

14  
15           **35.**    One or more computer-readable media having computer-readable  
16 instructions thereon which, when executed by one or more computers, cause the  
17 computers to implement the method of claim 30.

18  
19           **36.**    A method of managing resources comprising:  
20           indicating that a handle is suspended in a handle database; and  
21           reinstating a handle that is indicated as suspended in the handle database by  
22 having the handle assume an assigned state in which it can be validly dereferenced  
23 to obtain a pointer to a resource.

1           **37.**    The method of claim 36, wherein said indicating comprises setting a  
2 flag to indicate that the handle is suspended.

3  
4           **38.**    The method of claim 36, wherein said indicating comprises  
5 manipulating a handle value in the handle database to indicate that the handle is  
6 suspended.

7  
8           **39.**    One or more computer-readable media having computer-readable  
9 instructions thereon which, when executed by one or more computers, cause the  
10 computers to implement the method of claim 36.

11  
12           **40.**    A method of managing resources comprising:  
13 receiving a handle value;  
14 determining whether the handle value is suspended; and  
15 if the handle value is not suspended, returning a reference pointer that  
16 points to a resource with which the handle is associated.

17  
18           **41.**    The method of claim 40 further comprising determining whether the  
19 handle is valid and returning a reference pointer only if the handle is valid and not  
20 suspended.

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22           **42.**    The method of claim 41 further comprising returning a null pointer  
23 if the handle is invalid or suspended.



1           **43.**     The method of claim 40 further comprising returning a null pointer  
2 if the handle is suspended.

3  
4           **44.**     The method of claim 40 wherein the handle has more than two states  
5 into which it can be placed, the states comprising:

6                 an assigned state in which the handle is associated with a resource and can  
7 be dereferenced to obtain a pointer to that resource;

8                 an unassigned state in which the handle is available for assignment to a  
9 particular resource; and

10                a suspended state in which the handle is associated with a particular  
11 resource but cannot be dereferenced to obtain a pointer to that resource.

12  
13           **45.**     The method of claim 44 further comprising reinstating a handle  
14 from the suspended state to the assigned state.

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16           **46.**     The method of claim 44 further comprising releasing a handle from  
17 the suspended state to the unassigned state.

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19           **47.**     One or more computer-readable media having computer readable  
20 instructions thereon which, when executed by one or more computers, cause the  
21 computers to:

22                 receive a handle value;

23                 determine whether the handle value is suspended; and

24                 return a reference pointer that points to a resource with which the handle is  
25 associated, if the handle is not suspended.

1  
2       **48.**     The computer-readable media of claim 47, wherein the instructions  
3 cause the computers to suspend an assigned handle, the suspended handle being  
4 associated with a particular resource but being unable to be dereferenced to obtain  
5 a pointer to that resource.

6  
7       **49.**     A method of managing resources comprising:  
8       defining a handle database that contains information pertaining to a  
9 plurality of handles, the information comprising a handle value; and  
10       suspending a handle by adding a value to the handle value.

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12       **50.**     The method of claim 49 further comprising reinstating the  
13 suspended handle by subtracting the value from the handle value.

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15       **51.**     The method of claim 49 further comprising releasing the handle.

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17       **52.**     The method of claim 49, wherein said value comprise a handle  
18 range step value.

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20       **53.**     The method of claim 49, wherein said value comprises a power of 2.  
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22  
23  
24  
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1           **54.**    The method of claim 49, wherein the handle database comprises a  
2 table having a table size that corresponds to the number of handles that are  
3 available for assignment, and wherein the suspending comprises adding a value to  
4 the handle value that is larger than the table size.

5  
6           **55.**    One or more computer-readable media having computer-executable  
7 instructions thereon which, when executed by a computer, implement the method  
8 of claim 49.

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